

-- 24. The combustion turbine system according to claim 3 wherein said fuel is a liquid and said preselected temperature is approximately 200°F (93°C).

AB 25. The combustion turbine system according to claim 3 wherein said fuel is natural gas and said preselected temperature is approximately 1000°F (540°C).

26. The combustion turbine system according to claim 14 wherein said fuel in heat exchange relationship with said combustion gas flows at a rate approximating 80,000 lb./hr. --

REMARKS

In the first section of the Office Action, the Examiner has required an election of species. As now amended, Claims 1-3, 6-9, 12-17, 21, 22 and 24-26 are generic to the species shown in Figures 1-4. In addition, Claims 4 and 5 are specific to the species illustrated in Figures 1 and 2; Claims 10 and 11 are specific to the species illustrated in Figure 2; Claims 18 and 23 are specific to the species illustrated in Figures 3 and 4; and Claims 19 and 20 are directed to the species illustrated in Figure 4. Applicants elect full examination of the species illustrated in Figure 1 which requires consideration of Claims 1-9, 12-17, 21, 22 and 24-26.

Upon the allowance of either Claims 4 or 5, which are generic to the species of both Figures 1 and 2, Applicants respectfully request reconsideration of Claims 10 and 11, which depend thereon and are specific to the species illustrated in Figure 2. Similarly, following allowance of generic Claim 3 Applicant respectfully requests reconsideration of Claims 18, 19, 20 and 23 which depend thereon.

Claims 3-20 and 23 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. More particularly, the Examiner concluded that Claims 2 and 3 were redundant, claiming the same subject matter. It is respectfully believed that the foregoing amendment to Claim 2 should overcome this objection.

15 The Examiner further asserted, under the Section 112 objection, that Claim 10 additionally recites that the heated fuel line section is in a by-pass channel, a feature exclusive to the species in Figures 2 and 4. Claim 10's chain of dependency, however, includes Claim 5, which states that the heated fuel line

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section is in a turbine exhaust stack. This feature is found in the species of Figure 1 but not in the species of Figure 2 and Figure 4. The Examiner then concluded that Claim 10 was in conflict with parent Claim 5 since these claims recite features that are mutually exclusive to different species. Claim 5 has been amended to overcome this rejection. As amended, it's clear that the fuel line is placed in heat transfer relationship with the combustion gas traversing the exhaust gas stack; not necessarily in the exhaust gas stack. As shown in the Figure 2 species the by-pass line is taken at an inlet along the exhaust gas stack with the outlet positioned at a slightly higher elevation along the exhaust gas stack to reintroduce the gas into the stack from which it is exhausted. Thus, the amendment to Claim 5 should overcome the Examiner's concern.

The remaining claims rejected under Section 112 were included because of their dependency. Thus, the foregoing amendments should overcome these objections as well.

Claims 1, 2, and 21 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Pfenninger.

Pfenninger describes a power plant operated by compressed gas under conditions where the pressure of the fuel gas supplied to the plant is greater than that which is required or necessary in the combustion chamber of the power plant. The initial gas pressure of up to 60 atmospheres must therefore be reduced to 3 to 12 atmospheres. To solve this problem Pfenninger expands the gas through an expansion engine interposed ahead of the combustion chamber. The expansion engine is connected to the turbine shaft to increase the efficiency of the overall operation. In this manner, the high pressure inherent in natural gas is reduced in efficient manner to a level suitable to use in a combustion turbine. Pfenninger also compensates for the inherent cooling of the natural gas that occurs as it goes through the expansion engine, to avoid the formation of ice which can otherwise damage the expansion engine. Pfenninger does this by heating the natural gas prior to effecting the expansion and mentions that the wasted exhaust gases of the power plant are preferably used for this purpose. The reference does not mention the temperature to which the gas is heated, but the objective is stated to maintain the gas above the dewpoint so ice is not formed.

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In contrast to the teachings of Pfenninger, Applicants' amended Claim 1 includes a controller for adjusting the amount of heat imparted by the exhaust gas to the fuel prior to the fuel being introduced into the combustor, to maintain at least a portion of the fuel at a substantially elevated selected temperature relative to ambient conditions, within a given temperature range. In contrast, it appears that Pfenninger's objective is to maintain the fuel gas at ambient conditions. Furthermore, it does not appear that Pfenninger employs a control means to maintain the temperature at a preselected value within a given temperature range.

Applicants' amended Claim 2 further distinguishes from Pfenninger in specifying that the preselected temperature is determined, from a constituent analysis of the fuel, to approach a temperature at which the fuel burns most completely, substantially destroying undesirable by-products, while remaining below the temperature that would otherwise cause thermal decomposition of the fuel's constituents. For this further reason Claim 2, which is dependent upon Claim 1, further distinguishes over Pfenninger. The amendment to Claim 21 incorporates the amended changes to Claim 1 and, therefore, should be similarly allowable.

Claims 1, 2, 21 and 22 are further rejected under 35 U.S.C. § 102(b) as being anticipated by Arenson. The Examiner referred to Figure 1 of Arenson noting that fuel line section 25 is heated by the turbine exhaust 22 before being transferred to the turbine combustor system via lines 74 and 81. With regard to Claim 22, the Examiner noted that the heated fuel is also mixed with unheated fuel from by-pass 46.

Arenson describes a process and apparatus for vaporizing liquified natural gas with turbine exhaust gases wherein the vaporized natural gas is passed through heat exchange tubes employed to cool the input air to the turbine. The stream of liquified natural gas is vaporized and heated by the turbine exhaust gases to a temperature which will bring about the formation of a minimum quantity of ice on the outside surfaces of a first bank of heat exchange tubes, and is passed through the first bank of heat exchange tubes to cool the turbine input air. A second stream of liquified natural gas is then combined with the vaporized natural gas stream to cool the resulting combined stream to a minimum temperature which will bring about the formation of a minimum quantity of ice on the outside surface of a second

bank of the heat exchange tubes. The combined stream is then passed through the second bank of heat exchange tubes so that the turbine input air is cooled further.

Accordingly, Arenson employs the combustion gases to heat the liquified gas to a vapor at a temperature which will bring about the formation of a minimum quantity of ice on the outside surfaces of the first bank of heat exchange tubes and mixes the heated vapor fuel with unheated fuel in a subsequent heat exchange tube bank to cool the combined stream to a temperature which will bring about the formation of a minimum quantity ice on the outside surfaces of the second bank which is used to cool the input air stream to a turbine combustor. Arenson's controller that mixes the unheated fuel with the heated fuel is employed to cool the input air to the turbine and not to maintain the temperature of the fuel at substantially elevated preselected temperature relative to ambient conditions as required by Applicants' amended Claim 1. Furthermore, the temperature of Arenson's fuel is not determined, as called for in Claim 2, from a constituent analysis of the fuel, to approach a temperature at which the fuel burns most completely, substantially destroying undesirable by-products while remaining below the temperature that would otherwise cause thermal decomposition of the fuel's constituents. For this further reason, it is believed that Claim 2 further distinguishes over Arenson. As previously mentioned, Claim 21, as amended, includes the modifications incorporated into Claim 1, and for that reason should be similarly allowable. Claim 22 further defines the controlling step as comprising mixing unheated fuel with the heated fuel to obtain the elevated temperature called for in Claim 21. As previously noted, Arenson mixes the heated and unheated fuel to reduce the temperature of the fuel to a relatively low temperature, contrary to the teachings of Applicants. For this further reason, it is respectfully asserted Applicants' claims distinguish over Arenson.

Applicants have recently received an International Search Report issued in the corresponding PCT Application. The search report is dated April 24, 1998, well within three months of the certification required in 37 CFR § 197(e)(1) with regard to communications from a foreign patent office in a counterpart application. The International Search Report is included in an Information Disclosure Statement filed herewith and cites the following references as being pertinent to the counterpart application.

The reference to Scharpf (EPO 0 634 562 A) cited in the search report, describes an integrated gasification humid air turbine which utilizes at least a portion of the heat of the compression of an oxygen product to heat water to saturate the compressed, gas turbine feed air. Page 4, lines 30-38 were cited as relevant. The reference states starting on line 35 that "This heated, saturated, compressed, first feed air portion, in line 132, is then combusted in combustor 134, with fuel gas, via line 150, which has also been heated in the recuperator 130." There does not appear to be any mention that the fuel is heated to an elevated temperature or that the temperature range of the fuel is controlled within a preselected range.

The Metallgesellschaft reference (BE 20 05 656 A) is entirely in German and an English counterpart, U.S. Patent 3,736,485 is enclosed. Reference is made to page 10, last paragraph and page 12, line 21 of the German text. After reviewing the U.S. patent, Applicant was not able to discern the cited section. The reference describes a process for operating a gas turbine plant supplied with gaseous fuels and combustion air. The gas turbine is supplied with flu gases from the combustion chamber and both the fuel and the combustion air are enriched with water vapor to lower the temperature of the fuel mixture entering the gas turbine. The water vapor is heated by the exhaust gases exiting the turbine before being applied to the fuel/air mixture. Thus, it appears the heated water is used to lower the temperature of fuel mixture rather than raise it.

The reference to the patent abstracts of Japan, volume .012 which abstracts Application No. 61229156, assigned to Mitsubishi Heavy Industries, Ltd., summarily states that the fuel to the gas turbine is raised in its temperature through heat exchanging with the gas turbine exhaust gas in a fuel treating system. It goes on to state that the exhaust gas is adjusted by an inlet damper and outlet damper at a branch duct so as to meet the quantity of consumed fuel. There is no mention in the abstract of the purpose of raising the temperature of the gas or whether the inlet damper or outlet damper is intended to control the quantity of heat imparted to the fuel to maintain it within either a fixed or elevated range. A copy of the full patent and translation are enclosed. It appears that the exhaust duct is divided into two or more flow paths with various components of the combined cycle power generating system disposed among the flow paths to extract the exhaust gas energy. The

distribution of the exhaust gas among the several flow paths is determined by the position of flow dampers. The fuel is preheated in one of the exhaust flow paths and reacted within a fuel vaporizer with a catalyst, which is also in heat exchange relationship with one of the exhaust flow paths. The object is to create a secondary fuel with high fuel energy through decomposition by means of a chemical reaction. The reference does not appear to use a controller to maintain the temperature of the fuel at a preselected temperature nor is that temperature maintained below that which would otherwise cause thermal decomposition of the fuel constituents. On the contrary, it appears that the object of the reference is to cause a change in the composition of the fuel, employing a catalyst to achieve the requested temperature to obtain that result. The improvement of the reference appears to be directed to minimizing the quantity of catalyst required for this purpose.

The reference to Rice (WO 96 12091 A) describes a process and equipment for generating useful power comprising a special split steam heat recovery boiler in combination with the gas turbine and steam turbine in a combined cycle system. Page 25, line 1, page 26, paragraph 2 and Figures 16 and 17 are cited as relevant. The object of the reference is to transform a hydrocarbon fuel; preferably natural gas, predominantly methane. As stated in paragraph 1 on page 25, the gas is heated, but it is not clear that it is heated with the exhaust gas of a gas turbine and the temperature is chosen high enough to change the constituents within the gas, which is contrary to Applicants' objective. The second paragraph on page 26, refers to Figures 16 and 17, states that the high pressure output may feed a gas stream Y path for topping off the steam turbine and a low pressure output may feed a gas stream X path for fuel reforming ("and steam super heating") and subsequent burning in the gas turbine 20. The paragraph goes on to say that the optimum amount of low pressure steam may be generated by steam path X to match the desired steam to natural gas weight and size/volume ratio for optimum gas reforming. The reference also calls for a supplementary burner to control the proper gas path X temperature. The reference does not outwardly appear relevant to Applicants' invention.

U.S. Patent 3,300,965 (Sherlaw) does not apply but was cited illustrative of the relative state of the art. Sherlaw describes a gas turbine engine fuel heating and oil cooling system where a heat exchanger extracts heat from the

oil cooling medium and transfers that heat to the fuel. The reference discusses fuel temperatures roughly heated to 80°C which translates to approximately 176°F. The reference does not use the turbine exhaust gas to heat the fuel; operates at lower fuel temperatures than are employed by Applicants' invention; and does not base the input temperature of the fuel on the type of fuel employed or an analysis of the fuel's constituents. For these several reasons, it is believed the reference was appropriately characterized by the International Search Report.

Accordingly, Applicants have complied with the election of species required by the Examiner; have amended the claims to overcome the objections raised under 35 U.S.C. § 112; and with those amendments have clearly distinguished the claims over the references to Pfenninger and Arenson, and those cited in the International Search Report. Thus, reconsideration, allowance and passage to issue of this application are respectfully requested.

Respectfully submitted,



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